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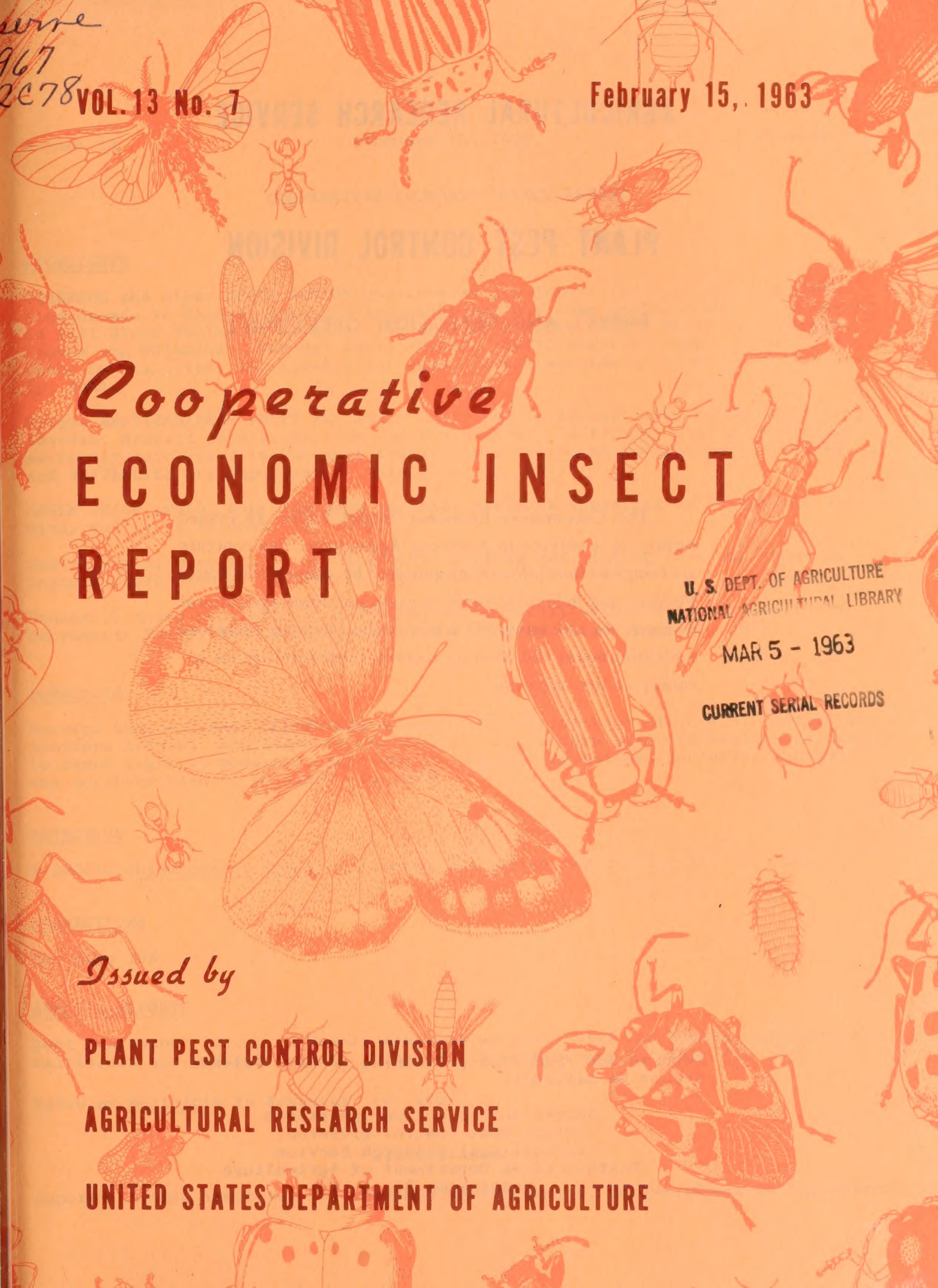

Cooperative ECONOMIC INSECT REPORT

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PLANT PEST CONTROL DIVISION

AGRICULTURAL RESEARCH SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH SERVICE

PLANT PEST CONTROL DIVISION

SURVEY AND DETECTION OPERATIONS

The Cooperative Economic Insect Report is issued weekly as a service to American Agriculture. Its contents are compiled from information supplied by cooperating State, Federal, and industrial entomologists and other agricultural workers. In releasing this material the Division serves as a clearing house and does not assume responsibility for accuracy of the material.

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Survey and Detection Operations
Plant Pest Control Division
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Volume 13 February 15, 1963 Number 7

COOPERATIVE ECONOMIC INSECT REPORT

HIGHLIGHTS

GREENBUG and other GRAIN APHIDS continue at low population levels. PEA APHID noneconomic in Kansas, Arkansas and Oklahoma, but some controls may be necessary in Salt River Valley of Arizona. No SPOTTED ALFALFA APHIDS found in Arkansas, Kansas and Oklahoma. Percent adult ALFALFA WEEVIL survival apparently high in Cache County, Utah, and surveys for eggs, larvae and adults negative in Georgia. (p. 103).

Single MEDITERRANEAN FRUIT FLY adult collected in Steiner trap at Lauderdale-by-the-Sea, Broward County, Florida, on February 4. In Florida citrus groves not seriously defoliated in December freeze, only scattered infestations of MITES and WHITEFLIES are important at this time. (p. 104).

GREEN PEACH APHID, FALL ARMYWORM and BEET ARMYWORM appearing on lettuce in Salt River Valley of Arizona. (p. 105).

Medium larval populations of CALIFORNIA OAKWORM defoliating live oak trees in Santa Barbara County, California. (p. 105).

Unusually heavy populations of MOSQUITOES currently occurring in cities in Sacramento Valley and upper San Joaquin Valley of California. (p. 107).

FORECASTS

Surveys indicate BEET LEAFHOPPER movement to cultivated districts of central and southern Arizona, southeastern California, and eastern Utah and western Colorado to range light to moderate; movement to southern Nevada and southern, central and northern Utah to be light. (p. 105).

DETECTION

A COCCID (*Dysmicoccus lasii*) collected in Florida for first time. (p. 106).

CORRECTIONS

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SPECIAL REPORTS

Beet Leafhopper Survey in Desert Areas of Southern Utah and Nevada, Southeastern California and Central Arizona - January 18 to February 1, 1963. (p. 105).

Notes on *Heliothis* in Arkansas. (p. 109).

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Reports in this issue are for week ending February 8, unless otherwise indicated.

WEATHER OF THE WEEK ENDING FEBRUARY 11

Temperatures for the week averaged from 10° to 25° above normal (near record levels) from the western Great Plains to the Pacific coast, about normal in the Mississippi Valley, and below normal by 3° to 6° in the East except 6° to 12° below in the Hudson Valley. This was the second consecutive unusually warm week in the Far West, and the fourth consecutive abnormally cold week in the Northeast. This week was warmer than the previous week in nearly all sections, and the first warmer than normal week in most of the Great Plains since the first week of the year. A high of 71° at Walla Walla, Washington, on the 4th, was the highest temperature recorded there in February since 1886.

A cold wave moved across the northeast quarter of the Nation on Friday, reducing temperatures to subzero levels in most of New England, New York, Pennsylvania and some other areas of adjoining States. Burlington, Vermont, recorded -20°.

Another cold wave preceded by snow was moving down through the midcontinent area at the end of the period. It was not nearly so severe as those in January, but minima in the Dakotas ranged from 0° to -10° and freezing extended to the west Gulf coastal areas.

Precipitation was heavy along the Pacific coast, in sections of the lower Rockies, an area including portions of eastern Arkansas and western Tennessee, and in parts of Florida and the south Atlantic coast. Elsewhere amounts generally were light to moderate, except that little or none fell in Nevada and western Utah and from southern Texas eastward through Louisiana, Mississippi and Alabama.

Substantial snowfall occurred in the southern Rockies. As much as 14 inches were reported in the northern mountains of New Mexico. But elsewhere in the Far West there was little new snowfall and the mountain snowpack remained below normal. In Washington, the snowpack is the lowest of record for the time of year. High temperatures in the West melted snow at lower elevations.

Snow cover east of the Rockies was heaviest in Maine, with over 2 feet of snow covering northern and interior sections. Greenville, Maine, reported 46 inches on the ground. In the remainder of New England and in New York, Pennsylvania and northern New Jersey, depths generally range from 3 to 6 inches, except more in the mountains and little or none along the coast. In the Midwest, depths range from an inch in central Illinois and Indiana, up to more than 20 inches in extreme northern Michigan. Snowfall preceding the weekend cold wave extended to the Southern States, and on the morning of the 12th, Shreveport, Louisiana, and Jackson, Mississippi, each reported an inch of snow on the ground. (Summary supplied by U. S. Weather Bureau).

CEREAL AND FORAGE INSECTS

GREENBUG (Schizaphis graminum*) - NEW MEXICO - Recent cold temperatures have frozen back wheat and drastically reduced aphid populations in Curry County fields. (N. M. Coop. Rpt.). OKLAHOMA - Populations continue at noneconomic level throughout all small grain sections of State. Surveys negative in many areas. Highest count reported averaged 7 per linear foot in one Muskogee County field. (Okla. Coop. Sur.). KANSAS - None observed in wheat and barley fields checked in Sedgwick, Sumner, Harper, Kingman and Reno Counties, south central. (Peters).

ENGLISH GRAIN APHID (Macrosiphum avenae*) - ARKANSAS - None found in fields checked in northwest. Very little green growth due to cold weather during January. (Ark. Ins. Sur.).

GRAIN APHIDS - OKLAHOMA - ENGLISH GRAIN APHID (Macrosiphum avenae*), APPLE GRAIN APHID (Rhopalosiphum fitchii) and CORN LEAF APHID (R. maidis) counts continue at very low level in all areas, with negative findings in many areas. (Okla. Coop. Sur.).

SOUTHWESTERN CORN BORER (Zeadiatraea grandiosella) - OKLAHOMA - Of 25 stalks checked in Beckham County, 23 were girdled. Of 15 larvae recovered, only one alive. In 2 fields checked in Choctaw County, 20 and 22 percent of stalks girdled, with no live larvae recovered. (Okla. Coop. Sur.).

A CUTWORM (Chorizagrotis sp.) - CALIFORNIA - Larvae, probably a species of this genus, heavy on leaf blades of rye in Alturas, Modoc County. (Cal. Coop. Rpt.).

WHEAT CURL MITE (Aceria tulipae) - CALIFORNIA - Medium on Lolium multiflorum (Italian ryegrass) in Berkeley, Alameda County. (Cal. Coop. Rpt.).

PEA APHID (Acyrthosiphon pisum*) - ARKANSAS - None found in fields checked in northwest. Very little green growth on cereal and forage crops due to cold weather during January. (Ark. Ins. Sur.). OKLAHOMA - Very light population found in only one field in Garvin County; all other surveys negative. (Okla. Coop. Sur.). KANSAS - None found in examination of alfalfa in south central area. (Peters). ARIZONA - Appearing on annual flowers in Salt River Valley; some controls may be necessary if parasites do not exert control. (Ariz. Coop. Sur.).

SPOTTED ALFALFA APHID (Therioaphis maculata) - ARKANSAS - None found in fields checked in northwest. Very little green growth on forage crops due to cold weather during January. (Ark. Ins. Sur.). OKLAHOMA - Checks negative in southeast, south central and central areas. (Okla. Coop. Sur.). KANSAS - None found during examination of alfalfa in south central area. (Peters).

ALFALFA WEEVIL (Hypera postica) - UTAH - Percent of adult survival apparently high in Cache County areas where checks have been made. Activity noted in Cache Valley on February 5 when temperatures were around 60°F. (Knowlton). GEORGIA - Surveys in several northwest and northern counties negative for eggs, larvae and adults. (Johnson).

CLOVER LEAF WEEVIL (Hypera punctata) - KANSAS - Trace larval counts noted in alfalfa in Sumner County, south central. (Peters).

ARMY CUTWORM (Chorizagrotis auxiliaris) - OKLAHOMA - Activity greatly reduced since onset of severe cold weather. Counts ranged 0.5-1 per linear foot of row in Major, Alfalfa, Grant and Garfield Counties. (Okla. Coop. Sur.).

WINTER GRAIN MITE (Penthaleus major) - OKLAHOMA - Light, scattered counts of up to 14 per linear foot noted in Tillman County; only scattered individuals observed in fields checked in Kingfisher County. None found in central, south central and northwest areas. (Okla. Coop. Sur.).

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* See CEIR 13(5):84.

FRUIT INSECTS

MEDITERRANEAN FRUIT FLY (Ceratitis capitata) - FLORIDA - Single adult male collected in Steiner trap at Lauderdale-by-the-Sea, Broward County, February 4. (Fla. Coop. Sur.).

Citrus Insect Situation and Outlook in Florida - End of January 1963

Special Comment - Of the 130 mature groves regularly examined in survey, 66 nearly or completely defoliated by December freeze and 8 of these suffered wood damage. The 64 groves that escaped with moderate to no defoliation were mostly close to the east coast or along southernmost fringes of citrus belt. In groves defoliated in late December, nearly all insect and mite populations are very low, with but few exceptions. Where CITRUS RUST MITE (Phyllocoptruta oleivora) was abundant on fruit in December, most fruit infestations are still near same level. Where a SNOW SCALE (Unaspis citri) was present in December, population is at similar level. This pest is only on wood and was little affected by the freeze. Defoliated groves put out new growth in January. In warmer areas, this growth is about half expanded. Many bloom buds have developed and some are open. In colder areas, new growth is smaller and weaker. Some withering and dropping of this weak flush has been observed.

Outlook - In defoliated groves, all new flush has been substantially free of pests to date, but melanose lesions, RUST MITES and a few SPIDER MITES are appearing. Very few APHIDS have been seen either on citrus or on weed hosts. Although the large amount of tender growth will favor buildup of aphids, mites and whiteflies, present population of these species in damaged groves is so low that few infestations of importance are expected until March. In undamaged groves, pest populations are near December levels and all are below normal for January except TEXAS CITRUS MITE (Eutetranychus banksi), WHITEFLIES, GLOVER SCALE (Lepidosaphes gloverii), CHAFF SCALE (Parlatoria pergandii) and YELLOW SCALE (Aonidiella citrina). January 1963 data from 64 groves not seriously defoliated given below. In these groves, only scattered infestations of mites and whiteflies are important at this time.

CITRUS RUST MITE (Phyllocoptruta oleivora) infested 43 percent of groves; 21 percent economic. TEXAS CITRUS MITE (Eutetranychus banksi) infested 34 percent of groves; 21 percent economic. CITRUS RED MITE (Panonychus citri) infested 24 percent of groves; 12 percent economic. PURPLE SCALE (Lepidosaphes beckii) infested 67 percent of groves; none economic. FLORIDA RED SCALE (Chrysomphalus aonidum) infested 26 percent of groves; none economic. BLACK SCALE (Saissetia oleae) infested 32 percent of groves; none economic. GLOVER SCALE (Lepidosaphes gloverii) infested 62 percent of groves; none economic. CHAFF SCALE (Parlatoria pergandii) infested 73 percent of groves; none economic. WHITEFLIES infested 81 percent of groves; 20 percent economic. (W. A. Simanton (Citrus Expt. Sta., Lake Alfred)).

CALIFORNIA RED SCALE (Aonidiella aurantii) - CALIFORNIA - Adults medium on dooryard lemon in Pinedale, Fresno County. (Cal. Coop. Rpt.).

A SCARAB (Anomala nigropicta) - FLORIDA - Severely infested Citrus aurantifolia at Lehigh Acres, Lee County (Feb. 1). Beetles completely defoliated lime tree in very short period. Also infested Saintpaulia sp. at Ft. Myers, Lee County, January 28. (Fla. Coop. Sur.).

PEACH TWIG BORER (Anarsia lineatella) - CALIFORNIA - Medium in apricot trees in Niles area, Alameda County. (Cal. Coop. Rpt.).

TRUCK CROP INSECTS

Beet Leafhopper Survey in Desert Areas of Southern Utah and Nevada, Southeastern California and Central Arizona - January 18 to February 1, 1963

Surveys indicate **BEET LEAFHOPPER** (*Circulifer tenellus*) movement to cultivated districts of central and southern Arizona, southeastern California, and eastern Utah and western Colorado to range light to moderate; movement to southern Nevada and southern, central and northern Utah to be light.

Generally, beet leafhopper movement is expected to be light to moderate from breeding areas south of the 34th° parallel and light from areas to the north of this line. Rains during December and early January stimulated good annual weed host development in most of winter breeding areas in Arizona. Dry soil conditions in western Arizona and southeastern California produced spotty distribution of host plants. Few areas with host plant cover were found north of the 34th° parallel. Unusually cold weather in mid-January damaged host plants in some areas and may have caused some reduction of overwintering leafhopper populations.

Host plants were found at 38.7 percent of the 10-mile sampling points, compared with 38 percent in 1962, 34 percent in 1961, 53 percent in 1960, 10 percent in 1959, 70 percent in 1958 and 14 percent in 1957. The average number of beet leafhoppers found in areas where host plants were present was 0.02 per square foot, compared with 0.012 in 1962, 0.02 in 1961, 0.014 in 1960, 0.05 in 1959 and 0.66 in 1958.

This report covers only the beet leafhopper situation as found in the area surveyed. It does not have reference to populations that may have overwintered in local breeding areas in northern and eastern Utah, and in western Colorado and Nevada. (H. H. Blakemore).

GREEN PEACH APHID (*Myzus persicae*) - ARIZONA - Prevalent numbers appearing on lettuce in Salt River Valley. (Ariz. Coop. Sur.).

FALL ARMYWORM (*Laphygma frugiperda*) - ARIZONA - Beginning to appear on lettuce in Salt River Valley. (Ariz. Coop. Sur.).

BEET ARMYWORM (*Spodoptera exigua*) - ARIZONA - Appearing on lettuce in Salt River Valley. (Ariz. Coop. Sur.).

FOREST, ORNAMENTAL AND SHADE TREE INSECTS

CALIFORNIA OAKWORM (*Phryganidia californica*) - CALIFORNIA - Medium larval populations defoliating live oak trees in Santa Barbara County. This is rather late for this pest to be active. Oaks have been severely damaged by this species in many locations over State this year. (Cal. Coop. Rpt.).

FALL CANKERWORM (*Alsophila pometaria*) - KANSAS - Few scattered egg masses noted on small pin oak nursery stock in Johnson County, east central, January 9. (Thompson).

APHIDS - FLORIDA - *Eulachnus rileyi* collected on *Pinus* sp. at Longwood, Seminole County, December 3, 1962, by C. O. Youtsey; this is second record for Department of Plant Industry. *Cinara longispinosa* heavily infested *Pinus serotina* at Gainesville, Alachua County, January 11. (Fla. Coop. Sur.).

EUONYMUS SCALE (*Unaspis euonymi*) - OKLAHOMA - Heavy infestation of 15-20 per leaf reported from Cleveland County. (Okla. Coop. Sur.).

COCCIDS - FLORIDA - *Dysmicoccus lasii* collected on *Borreria terminalis* at Miami, Dade County, July 28, 1961. Det. by R. F. Wilkey. This is a new State record. (Fla. Coop. Sur.). CALIFORNIA - Adults of *Rhizoecus cacticans* medium on roots and in soil around *Puya* sp. and *Anacampseros* sp. in a growing ground in Paramount, Los Angeles County. *Toumeyella pinicola* adults heavy on twigs of ornamental dooryard pine in Santa Maria, Santa Barbara County. (Cal. Coop. Rpt.).

Coccids in Florida - *Pseudaonidia clavigera* infested *Viburnum suspensum* at Largo, Pinellas County (Jan. 29). *Aspidiotus lataniae* moderate on 500 *Ilex burfordii* at Oviedo, Seminole County (Jan. 28). *Fiorinia theae* moderate on *Euonymus* sp. at Bunnell, Flagler County (Jan. 21) and on *Ilex burfordii*, at Oviedo (Jan. 28). *Parlatoria proteus* infested *Vanda* sp. at Naranja, Dade County (Jan. 8); orchids at Wakahoota, Alachua County (Jan. 11); and was moderate on *Euonymus* sp. at Bunnell (Jan. 21). *Pseudaulacaspis pentagona* was light on *Prunus persica* at Hastings, St. Johns County, in January; moderate on *Allamanda* sp. at De Leon Springs, Volusia County (Jan. 30). (Fla. Coop. Sur.).

PSYLLIDS - CALIFORNIA - Nymphs of *Psylla ribesiae* heavy on aralia nursery stock in Mountain View, Santa Clara County. Nymphs and adults of *Psylla uncatoides* light on young acacia trees in Santa Paula, Santa Barbara County. *Paratrioza lavaterae* heavy on *Lavatera assurgentifolia* in Montecito, Santa Barbara County, and San Ysidro, San Diego County. (Cal. Coop. Rpt.).

OMNIVOROUS LOOPER (*Sabulodes caberata*) - CALIFORNIA - Medium on *Dodonaea* sp., *Aralia* sp. and *Prunus* sp. nursery stock in San Luis Obispo and Morro Bay, San Luis Obispo County. (Cal. Coop. Rpt.).

EASTERN TENT CATERPILLAR (*Malacosoma americana*) - FLORIDA - Infested *Prunus serotina* at Gainesville, Alachua County, January 30. Det. by L. A. Hetrick. (Fla. Coop. Sur.).

A LEAF ROLLER (*Platynota stultana*) - CALIFORNIA - Heavy on juniper and cotoneaster nursery stock in Hemet, Riverside County. (Cal. Coop. Rpt.).

CUTWORMS - ARIZONA - Unspecified species appearing in flower beds in many parts of Salt River Valley. (Ariz. Coop. Sur.).

VEGETABLE WEEVIL (*Listroderes costirostris obliquus*) - CALIFORNIA - Larvae heavy in dichondra lawns in Colusa, Colusa County. (Cal. Coop. Rpt.).

A DRYWOOD TERMITE (*Kalotermes approximatus*) - FLORIDA - Infested *Persea borbonia* at Gainesville, Alachua County, January 29. Colony entered branch heartwood via dead branch stub; destruction of heartwood cylinder caused breakage of infested branch. Det. by L. A. Hetrick. (Fla. Coop. Sur.).

A STEM SAWFLY (*Hartigia cressonii*) - CALIFORNIA - Larvae heavy in rose canes in Los Banos, Merced County. (Cal. Coop. Rpt.).

TUMID SPIDER MITE (*Tetranychus tumidus*) - FLORIDA - This species and *Caloglyphus* sp. infested *Pittosporum tobira* at Brooksville, Hernando County, January 28. (Fla. Coop. Sur.).

INSECTS AFFECTING MAN AND ANIMALS

COMMON CATTLE GRUB (*Hypoderma lineatum*) - GEORGIA - Surveys made January 23 to February 1 in several central and southern counties. Of 295 animals examined, 54 infested; counts ranged 1-51 per animal, averaged 2 per animal. (Roberts). OKLAHOMA - Ranged 0-9 (average 4) per head on yearling steers in Stillwater area, Payne County, with fewer than one per head on mature animals. Counts ranged light to heavy in Bryan County, with 7-10 per head noted in McCurtain County and 15 per head in Cleveland County. (Okla. Coop. Sur.).

CATTLE GRUBS (Hypoderma spp.) - UTAH - Larvae have been appearing in backs of cattle in Cache County during past 2 weeks. (Knowlton).

CATTLE LICE - GEORGIA - Of 295 animals examined in surveys conducted during period January 23 to February 1, louse infestations found on 149 animals. Of specimens examined, 2 were Solenopotes capillatus, one was Bovicola bovis and all other specimens were Linognathus vituli. (Roberts). OKLAHOMA - Activity of several species continues on untreated animals throughout State. (Okla. Coop. Sur.). UTAH - Rubbing of some beef cattle noted at Richmond, Cache County. (Knowlton).

CHICKEN BODY LOUSE (Menacanthus stramineus) - ARKANSAS - Counts in flocks in Benton County (northwest) were light on 5 flocks, moderate on one flock and heavy on one flock. Survey method used described in CEIR 12(13):295. (Simco).

MOSQUITOES - CALIFORNIA - Unusually heavy populations currently occurring in cities in Sacramento Valley and upper San Joaquin Valley. Hibernating females have been activated by rain followed by unseasonably warm weather. These pests have created a severe nuisance which homeowners and some business establishments are having difficulty in controlling. (Cal. Coop. Rpt.).

EAR TICK (Otobius megnini) - NEW MEXICO - Populations increasing on cattle in Curry County. (N. M. Coop. Rpt.).

FOWL TICK (Argas persicus) - NEW MEXICO - Reports indicate populations range moderate to heavy and are a problem in several poultry houses in Curry and Dona Ana Counties. (N. M. Coop. Rpt.).

HOUSEHOLD AND STRUCTURAL INSECTS

BOXELDER BUG (Leptocoris trivittatus) - UTAH - Annoyance in northern and central area homes has been very common as result of recent warmer weather. (Knowlton).

ELM LEAF BEETLE (Galerucella xanthomelaena) - ARKANSAS - Adults present in homes in Fayetteville, Washington County (northwest). (Ark. Ins. Sur.).

COCKROACHES - ARIZONA - Unspecified species causing considerable annoyance to homeowners in central area of State. (Ariz. Coop. Sur.).

BROWN DOG TICK (Rhipicephalus sanguineus) - MARYLAND - Caused a nuisance in homes in Montgomery and Prince Georges Counties. (U. Md., Ent. Dept.).

TROPICAL RAT MITE (Ornithonyssus bacoti) - MARYLAND - Caused a nuisance in home at Centreville, Queen Annes County. (U. Md., Ent. Dept.).

EASTERN SUBTERRANEAN TERMITE (Reticulitermes flavipes) - FLORIDA - Collected at Gainesville, Alachua County. Winged reproductives flying from many woodland locations during early afternoon. Flights within heated buildings several days to several weeks earlier locally. (Hetrick).

A DRYWOOD TERMITE (Kalotermes snyderi) - ALABAMA - Heavily infested several household furnishings in Mobile County. Several articles damaged beyond repair at time of discovery. (Seibels).

STORED-PRODUCT INSECTS

WHITE-SHOULDERED HOUSE MOTH (Endrosis sarcitrella) - CALIFORNIA - Heavy in seed oats in Guadalupe, Santa Barbara County. (Cal. Coop. Rpt.).

INDIAN-MEAL MOTH (Plodia interpunctella) - MARYLAND - Adults emerged in Anne Arundel County home. (U. Md., Ent. Dept.).

CIGARETTE BEETLE (Lasioderma serricorne) - OKLAHOMA - Found infesting tobacco in Stillwater area, Payne County. (Okla. Coop. Sur.).

DRUGSTORE BEETLE (Stegobium paniceum) - OKLAHOMA - Causing concern in Oklahoma City and Tulsa areas. (Okla. Coop. Sur.).

YELLOW MEALWORM (Tenebrio molitor) - NEW MEXICO - Light to moderate infestations found among stored sacks and feed in Curry County. (N. M. Coop. Rpt.).

MISCELLANEOUS INSECTS

AN EARTHWORM MITE (Fuscuropoda agitans) - CALIFORNIA - Medium in mud and wet grain on dairy property in Cypress, Orange County. (Cal. Coop. Rpt.).

CORRECTIONS

CEIR 11(48):1085 - A LEAFHOPPER (Fieberiella florii) - OREGON - This is not a new State record for 1961. Recent determinations of leafhoppers collected at various locations in Oregon during 1949, 1950, 1951 and 1952 showed this species to be present prior to 1961. (Capizzi).

LIGHT TRAP COLLECTIONS

SOUTH CAROLINA - Charleston (Feb. 4-10) - ARMYWORM (Pseudaletia unipuncta) - 1; GRANULATE CUTWORM (Feltia subterranea) - 2.

NOTES ON HELIOTHIS IN ARKANSAS

By

W. P. Boyer, W. H. Whitcomb, Grover C. Dowell and Robert Bell 1/

The abundance and economic importance to several crops of Heliothis spp., primarily H. zea (Boddie), has created a need for more survey on this genus. As a result, survey has been increased during the past six years. Special attention has been given to first seasonal appearance,early-season life cycle, seasonal history, hosts, predators, species involved and surveys to determine areas within the State in which insecticide resistance may be developing or may have developed.

Even though early-season infestations of H. zea are seldom of economic importance in Arkansas, they are, however, the predecessors of midseason outbreaks. For this reason, a study was begun in 1957 to determine where and in what crops H. zea first appeared in Arkansas.

In 1935, Isely mentioned that moths of H. zea may be found in northwest Arkansas as early as April 13. He also pointed out that first-generation larvae may be swept from vetch or alfalfa in May and that they had been found damaging seedling corn.

At first, an attempt was made in this study to capture early-flying moths by the use of light traps. The traps were standard U.S.D.A. survey-type, equipped with two G.E. blacklight bulbs. Eggs were often discovered in the field before any moths were taken in the traps. Sweep nets were unsatisfactory, since the eggs would have been in the field a week before the small larvae were picked up in the net. The most satisfactory method proved to be direct examination of the plants in the field for eggs. This was particularly satisfactory on crimson clover. A hand lens was used for identification, and the eggs were then brought into the laboratory for rearing. A foot-square wooden frame was used for counts.

During early May of 1958, third-stage larvae were found in white clover in Bradley County and the next week in crimson clover in Conway County, Arkansas. On April 13, 1959, eggs were taken in three southwestern Arkansas counties. They were found in several different legumes but were most abundant in crimson clover. On April 11, 1960, eggs were collected in southwest Arkansas in much the same counties as in 1959. The eggs were again far more abundant in crimson clover. In 1960, eggs were taken in forty-five counties before the first of May. Egg counts varied from one to seventeen per square foot. Neither in 1959 nor in 1960, was a single larva found during the first three days of survey. Frosts, one or two nights before, may have killed them. After the middle of April, eggs could be found until the last week of May, indicating a gradual and somewhat scattered emergence. In 1961, eggs were found April 4 in three counties in southwest Arkansas. One second-stage larva was found in that area on the same date. In 1962, egg deposition was later than it had been in previous years; the first eggs were found April 25 in southwest Arkansas.

In 1959, crimson clover began to dry up about the first of May and was no longer attractive for egg deposition. In 1960, crimson clover began to dry up approximately May 10. Eggs were taken from early corn whorls and tomato terminals

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1/ Survey Entomologist, Entomologist, Extension Entomologist and former Graduate Student, respectively.

on May 7 in 1959 and on May 10 in 1960. The last eggs of the first generation were found on May 23 in 1959 and on May 27 in 1960. In both cases, the moths began to emerge between June 5 and June 10.

Early-season hosts included crimson clover, white clover, burclover, red clover, alsike clover, hop clover, alfalfa, vetch, rough peavine, evening-primrose (*Oenothera* sp.), lupine, tomato, corn and strawberry.

In the insectary, eggs laid before May 5 required 7 to 8 days to hatch. Larvae from these eggs required 30 to 36 days to reach the prepupal stage. The prepupal stage lasted 3 days. Pupae emerged in 14 to 18 days. Under these conditions, the total life cycle lasted 54 to 65 days. Larvae fed on alfalfa took approximately 2 days less from egg to prepupa than those fed on crimson clover. Those fed on corn whorls took slightly longer than those fed on crimson clover.

From March 1957 to June 1962, a special investigation gave important information on predators of *Heliothis* spp. in early-season crops.

Orius insidiosus (Say) appeared to be the most important single predator of early-season *H. zea*. It was taken simultaneously in early composites and legumes in late March in south Arkansas. It was particularly effective as an egg predator. At least four species of lady beetles fed on *Heliothis* eggs in early legumes in Arkansas. They were *Coleomegilla maculata* (Degeer), *Hippodamia convergens* Guérin-Méneville, *Olla abdominalis* (Say) and *Cycloneda munda* (Say). Early in the year, *Cycloneda munda* was the most abundant species in legumes. The nabids, *Nabis capsiformis* Germar, *N. ferus* (L.), *N. alternatus* Parshley, *N. roseipennis* Reuter, *N. sordidus* Reuter, and *N. deceptivus* Harris, and the lygaeid, *Geocoris punctipes* (Say), fed freely on *Heliothis* larvae. The nabids were found all winter in legume fields, particularly on warm days. *G. punctipes* appeared in early April in legume fields. Members of the genus *Zelus*, particularly *Z. exsanguis* (Stål) and *Z. cervicalis* Stål, were predators on the second and third-stage *Heliothis* larvae. They overwintered in leaf trash as nymphs, climbed onto nearby shrubs in early March, fed, transformed into adults, and flew to nearby small grain, legume and other cultivated fields. The genus *Polistes*, including *P. annularis* (L.), *P. exclamans* Viereck, and *P. rubiginosus* Lepeletier, preyed on large larvae. They were apparently more effective as predators in May than in April.

Species Study

In 1962, a survey was conducted to determine the relative abundance of *Heliothis zea* (Boddie) and *H. virescens* (Fabricius) in certain crops. Light trap collections at four locations are summarized in Table 1, page 112.

In total collections for the season, as shown in Table 1, *H. zea* outnumbered *H. virescens* 2,845 to 40 (a 71 to 1 ratio). The earliest *H. virescens* collected was one moth taken at Kelso the week of June 14-20, when four *H. zea* were taken. The largest number of *H. virescens* taken in any one-week period was 13 at Little Rock the week of August 16-22, when 183 *H. zea* were collected. The largest weekly catch of *H. zea* was 372 the week of July 16-22 at Kelso, when two *H. virescens* were taken. Larval collections from cotton are summarized in Table 2.

Survey has been used as a tool to detect resistant populations of bollworm, *Heliothis zea*, in cotton. The point-sample method of scouting cotton insects now being used in Arkansas is sufficiently sensitive that bollworm resistance can be detected from point-sample scouting records taken weekly. Counts taken by this method give the following information.

1. Number of row feet to obtain 200 green squares ¼ inch or larger in diameter -- four samples of 50 squares each.

2. Number of bollworm damaged green and flared squares on the feet of row covered under number 1.

3. Number of bollworm eggs and larvae in 100 terminals.

4. Insecticidal treatments including date, material, dosage, and rate and method of application.

In 1961, resistance was detected in two Arkansas counties, while in 1962, resistance was detected in 11 counties.

Survey was further used to study resistance by the collection of 6,992 larvae of H. zea from corn in 13 counties. These larvae were delivered alive to a laboratory where a uniform method of topical applications of insecticides was used. Indications of resistance were shown by the average number of larvae killed, which varied by counties from a low of 42 percent to a high of 90 percent.

With resistance of Heliothis spp. to certain insecticides apparently becoming more widespread, and with the increasing economic importance of this genus, comparable survey will be continued.

Reference: Isely, Dwight. 1935. Relation of Hosts to Abundance of Cotton Bollworm. Ark. Agr. Expt. Sta. Bul. 320:1-30.

Table 1 - Light Trap Collections - 1962

Heliothis zea and *H. virescens*

(N.R. - No Record; *Z.* - *zea*; *V.* - *virescens*)

Dates	Kelso		Hope		Little Rock		Morrilton		Total	
	Z.	V.	Z.	V.	Z.	V.	Z.	V.	Z.	V.
May 10-16	0	0	N.R.	N.R.	N.R.	N.R.	1	0	1	0
May 17-23	4	0	N.R.	N.R.	N.R.	N.R.	4	0	8	0
May 24-30	8	0	1	0	N.R.	N.R.	6	0	15	0
May 31-June 6	3	0	0	0	N.R.	N.R.	6	0	9	0
June 7-13	4	0	2	0	N.R.	N.R.	8	0	14	0
June 14-20	4	1	3	0	N.R.	N.R.	4	0	11	1
June 21-27	7	0	2	0	18	0	8	2	35	2
June 28-July 4	5	0	1	0	13	0	5	0	24	0
July 5-11	6	0	9	0	18	0	25	0	58	0
July 12-18	10	0	52	0	20	0	27	0	109	0
July 19-25	21	0	47	2	11	0	29	0	108	2
July 26-Aug. 1	28	1	9	0	46	0	15	0	98	1
Aug. 2-8	54	1	29	1	88	0	24	0	195	2
Aug. 9-15	122	0	26	3	104	8	19	0	271	11
Aug. 16-22	372	2	N.R.	N.R.	183	13	47	0	602	15
Aug. 23-29	44	2	N.R.	N.R.	200	0	59	0	303	2
Aug. 30-Sept. 5	52	2	N.R.	N.R.	N.R.	N.R.	38	0	90	2
Sept. 6-12	76	0	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	76	0
Sept. 13-19	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
Sept. 20-26	290	1	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	290	1
Sept. 27-Oct. 3	204	1	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	204	1
Oct. 4-10	281	1	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	281	1
Oct. 11-17	133	1	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	133	1
Oct. 18-24	42	0	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	42	0
							Grand Total		2,845	40

Table 2 - Bollworm Larvae Collected in Cotton - 1962

Late August Collections

County	Number of *H. zea*	Number of *H. virescens*
Chicot	55	0
Desha	154	2
Faulkner	49	0
Jackson	89	1
Jefferson	336	0
Johnson	20	0
Lee	38	0
Lincoln	110	0
Lonoke	11	0
N. Mississippi	57	0
Washington	11	0
Yell	15	0
Total	945	3

September - October Collections

County	Number of *H. zea*	Number of *H. virescens*
Desha - 9/26	21	7
Desha - 10/16	75	9
Total	96	16

Further larval collections were as follows:

Area	Date	Host	Number of *H. zea*	Number of *H. virescens*
Southeast Arkansas	September 5-12	Soybeans	238	0
Southeast Arkansas	September 13-26	Sorghum	69	0

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